ing member of the Institute of France. There seems little need to enumerate all the honours that were conferred on him during the half century that he was known as one of the distinguished zoologists of Europe.

In the important and indispensable catalogue of Scientific Papers published by the Royal Society, we find a list of over 130 memoirs ascribed to Prof. Von Siebold.

Failing health during the last few years interrupted this, up to 1874, steady flow, and Dr. Ehlers undertook much of the labour of editing the *Zeitschrift.* Those who had a personal knowledge of Von Siebold will remember his pleasant and friendly manners, the readiness with which he placed at the students' disposal all the information in his power, and the visitor to the Zoological Museum at Munich will not soon forget the vast stores, not only collected, but scientifically arranged under the superintendence of Von Siebold.

THE EGGS OF FISHES[1]

II.

THE condition of the fish-fauna of the various grounds may be estimated to some extent by the number of the floating ova near the surface. We have seen that Sars found the water crowded with the multitude of ova off the Loffoden Islands, where enormous numbers of cod are captured. In our seas no fishing-bank is so prolific, the greatest number of ova occurring on Smith Bank, off Caithness, and the next on the rich grounds off the Island of May—both of which present a great contrast with the meagre supply of eggs of round fishes floating in our own bay. The proportional numbers in each case accord very well with the captures of adult cod in the several areas.

No sight can be more interesting to the naturalist than the surface of the sea, in the condition just mentioned, about the beginning of April. The rough water of the great fishing-grounds—such as off Smith Bank, and somewhat further from land—is enlivened by large groups of gulls, guillemots, and the ubiquitous gannets, apparently feeding on the smaller fishes which have been attracted to the surface by the wealth of food. At short intervals the long dorsal fin of a large killer appears above the surface, and the water behind it is churned into foam by the powerful strokes of its tail; while a small group of bottle-noses (another kind of toothed whale) is recognised by the noise and foam, as one or more leap from the sides of a huge wave. The tow-net collects large quantities of ova and minute fishes which have just escaped from the egg. It further shows that innumerable minute crustaceans, such as Copepods (*e.g. Calanus finmarchicus*, Gun., and *Temora longicornis*, O.F.M.), multitudes of the young, or nauplius-stage, of sea-acorns, Sagittæ, and peculiar Annelids (*Ioida*) are present. It is evident, therefore, that the young fishes are placed in the midst of a rich surface-fauna, the more minute forms of which would readily serve as food.

In the foregoing remarks on the floating eggs of British food fishes, those of the cod, haddock, and whiting, have been chiefly alluded to. We shall now refer to others, either wholly or partially unknown till this year. I have already mentioned that Sars found certain floating eggs mingled with the former on the surface of the sea, and identified the young, after hatching, as gurnards. In the present case the eggs were removed from the adult gurnard, and hatched at St. Andrew's in about a week, so that a further step has been made. The eggs of the gurnard float as buoyantly as those of the cod and haddock, but they are considerably larger. Each has a very distinct oil-globule opposite the germinal area, which generally is directed downwards. Some are of opinion that the floating of the eggs of such fishes as we are now considering is due to the oil-globules, but the eggs of several fishes, *e.g.* those of the salmon, have a larger quantity of oil, and yet they do not float. The specific gravity of the eggs is slightly less than that of the sea-water; but the precise connection between the floating of the living ova and the sinking of the dead has yet to be made out. Such would form, indeed, a most valuable and interesting subject for investigation at the Marine Laboratory. So easy is it to hatch the eggs of the gurnard that the water in the instance just narrated was not changed. The rapidity with which the development of the embryo goes on in the egg is remarkable, for in 7 or 8 days the young are extruded, whereas in the salmon, for instance, no less than 60 days are required even in a room with a temperature much higher than that of the open air. If the eggs of the salmon are permitted to hatch in an ordinary river, a period of from 95 to 120 days is usually necessary for hatching. The very great difference, therefore, between the marine and freshwater fishes in this respect is apparent.

The only flat fish in which the ova had been found to float was the plaice, which Dr. Malm had examined in the Baltic. In May of this year, however, the eggs of the common flounder in St. Andrew's Bay showed the same feature. They floated buoyantly on the surface of the water. Prof. Huxley at this time having suggested that perhaps the floating or sinking of the ova was a question of temperature, the eggs of this species were used in some experiments. They had been removed from the fish on May 2, and placed in the Marine Laboratory. On the 5th the majority still remained on the surface, those on the bottom having been carried down by the attachment of sand-grains. A number from the surface were placed in a test-tube. After standing an hour the majority were floating on the surface, one or two lay on the bottom, while others rested in mid-water. Placed in a vessel of water at 98°, the eggs exhibited lively movements for several minutes, being carried up and down by the currents, but never remaining at the bottom. The test-tube felt quite warm to the touch, yet the eggs floated, and remained floating, as buoyantly in the warm water as in the cold, so that their floating in the sea is not a question of temperature.

An interesting sequel, further, remains to be told in connection with this experiment, in which the test-tube had been placed aside and forgotten. On May 10, while explaining the matter to Prof. Ewart, he noticed motion in the test-tube, and I found that the eggs which had been raised to a temperature of 98° had given birth to little flukes, which thus survived the exigencies of their surroundings, both as regards temperature and water. These little creatures are as symmetrical in outline as the young cod or haddock, an eye being placed on each side of the head, while in the adult flounder, as you are all aware, both eyes are on one side (the right or coloured one). The pigment is quite different from that of the young cod, being of a peculiar pale olive or brownish yellow by transmitted light, and the cells seem to be less branched. Their motions also diverge from those of the cod, for the little creatures hang head downwards in the water, either perpendicularly or obliquely, the yolk-sac being on the upper line of the slope. They then move upward, hang as formerly, or slowly descend, repeating these motions frequently. The young cod, on the other hand, dart nimbly about near the surface of the water, and bear themselves quite differently.

But to return to the ova. Before the summer that has just passed, it was not known whether the ova of the turbot, sole, and lemon-dab—all important and valuable food fishes—floated or sank. Accordingly such fishes were a source of special interest. It was not till the end of June and in July that perfectly ripe turbot could be procured, and then the small ova were found to float as buoyantly as any of the foregoing; and the same was proved to be the case with the eggs of the sole and lemon-dab—all these, moreover, being obtained in the act of spawning far out at sea, and in comparatively deep water. The ova of the long rough dab and the common dab were also added to the list of those with floating eggs. The notion, therefore, that such fishes seek the shallow water for the purpose of spawning is visionary, and mainly rests on the preconceived opinion that the eggs are deposited on the bottom.

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[1] Introductory Lecture delivered to the Class of Natural History in the University of St. Andrews, on November 10, by Prof. McIntosh, LL.D., F.R.S. Continued from p. 536.

Amongst the eggs of the cod floating on the surface of the water off the Island of May, in April, were vast numbers of very young sand-eels. The late Mr. Buckland states that they spawn in "May, June, and September," and that they deposit their eggs in the sand. They would rather seem to spawn in spring, and their eggs probably avoid the sand as much as possible by floating on the surface of the water. Sand is a most objectionable site for the eggs of certain fishes, and no less so for the embryo.

Without going into further detail, it is evident, therefore, that the eggs of many of the most valuable food fishes thus float near the surface of the sea, *e.g.* those of the cod, haddock, whiting, bib, and other Gadoids, mackerel, gar-fish, red mullet, weever, plaice, long rough dab, common dab, lemon-dab, sole, common flounder, and probably sand-eels. There is hardly a marine fish, excepting those of the herring group, which appears in our markets, but has this remarkable provision in regard to its eggs. It would also appear that some of these eggs range throughout the water, so as to be caught by a tow-net sunk many fathoms beneath the surface.

There can be little doubt that this wonderful provision is one of the main reasons why such marine fishes have held their own in the struggle for existence—not only with respect to their predatory neighbours, but still more in regard to the persistent inroads on their numbers made by man. Marine fisheries have hitherto been conducted as if practically inexhaustible, both lines and trawlers taking as much from the sea as possible, while no margin has ever been afforded the spawning fishes.

Let us for a moment glance at the working of this arrangement. The comparatively small eggs of the chief food fishes rise to the surface, or nearly to the surface, wherever the shoals of adult fishes happen to be feeding, and this occurs not during a brief period, but it extends over a considerable space of time. The tiny young in their helpless state are carried, along with multitudes of eggs, by every tide into sheltered creeks and bays, in the shallow water of which they find both safety and food. We are familiar with these tiny embryos, furnished with a yolk-sac—and so fragile that they would fall an easy prey to hosts of swimming crustaceans on which, in the adult state, they would hardly deign to feed—near the surface of the sea; but a hiatus yet remains in the history of the young cod, for instance, between the date of complete absorption of the yolk-sac and that in which it is found swimming in the forests of tangles in the laminarian region—for example, off the Castle and Pier Rocks, or even venturing into the harbour. There, as a rule, it is free from the pursuit of both liners and trawlers, and quietly grows apace, feeding on the swarms of minute crustaceans and the myriads of very young mussels which characterise such a region. In the early part of the season they range from one and a half to two inches, and are variegated with a series of pale spots, somewhat rectangular in outline. The general colour is olive, lighter or darker according to circumstances, though a few of the larger examples have a reddish hue, such as signalises the "rock-cod" of the liners, but the pale spots are similar. Many of these young cod are infested by parasitic crustaceans (*Chalimus*), which adhere by a long median process that penetrates the skin. They are accompanied in the laminarian region by the young of the coal-fish, whiting, pollack, rockling, long-spined cottus, and lump-sucker.

Sars is of opinion that the intermediate stage—about which, as above-mentioned, our knowledge is imperfect—is passed by the young cod-fish in the shelter of the jelly-fishes, on the rich grounds off the Loffoden Islands. It is true that once or twice young cod, of the intermediate stage, and coal-fish have been caught in our seas in the tow-net in July, but the result of the present observations gives no support to this view. The jelly-fishes in our seas are not in sufficient numbers at the time of the intermediate stage, especially in regard to the spawning in April, to act as shelter-forms to the young fishes. It is probable that as soon as they gain sufficient strength to withstand the force of the ordinary ebb-tides, they remain amongst the tangles and other seaweeds of our rocky shores, to which they have meanwhile been carried by the currents. While a few, therefore, are found here and there near the surface of the sea amongst other pelagic types, the majority of those in the intermediate stage probably swim somewhat deeper.

The after-history of the little cod of one and a half to two inches, which are found in considerable numbers off the Pier and Castle Rocks in the beginning of July, appears to be as follows. They remain in the laminarian region for some months (many being captured even at this season), and rapidly increase in size on the rich and abundant food placed within easy reach. Moreover, it is probable that in this region they are much less liable to the attacks of predatory fishes than in the open sea. We find, indeed, that, while young haddock and whiting abound in the stomachs of cod, haddock, gurnards, and other fishes, it is rare in our seas to find young cod of the size we are now considering. Prof. Sars, on the other hand, procured them abundantly in the stomachs of the pollack (a fish which swims high) off the Norwegian shores; but it has to be borne in mind that they form the chief feature of the young fish-fauna of the region at the time indicated. As they grow larger and bolder, they seek deeper water, and are found in numbers near rocky or rough ground, such as off the Bell-rock, and the North Carr rocks, and indeed all along the rocky eastern shores. They then mingle with their progenitors on the various fishing-banks, and are caught in numbers by both hook and trawl. The main cause of this migration from the shore seawards is probably the nature of the food, which, as the animals grow older, becomes of a different character, the larger Crustacea especially—such as hermit-crabs, Norway lobsters, and many short-tailed crabs—being eagerly sought after, along with various kinds of fishes. So far as our knowledge at present goes, a cod probably takes between three and four years to attain full growth.

A feature which requires special mention is that, when the shoals of young cod are watched at any of our rocky shores during several months, one is struck by the fact that throughout the period many small forms are present, that is, some do not appear to have grown; but we have seen that the spawning of the adult fishes extends over a considerable period, and, further, that only a portion of the eggs in any given fish come to maturity at once. There is thus a succession of young fishes coming at a certain stage shorewards, and another migrating outwards. This and other facts already mentioned show how intimately the in-shore ground depends on the off-shore; in other words, the eggs and very young fishes are carried from the offing by every tide during the season, while a constant stream of young fishes of a large size goes to swell the ranks of the adults beyond the three-mile limit. The prosperity of the one region is thus intimately associated with that of the other.

In this rapid sketch, then, it will have been observed how complex are the relations which surround the increase of marine fishes. Conspicuous above all others, however, is the remarkable provision whereby the eggs of almost all the chief food fishes, except the herring group, float at or near the surface of the water—so that they are carried hither and thither by every surge of the tide, or more steadily borne by the deeper currents to stock anew exhausted waters. The minute and imperfectly-developed embryos and the delicate young, moreover, are conveyed into regions best suited for their future growth and well-being. Further, we cannot but be impressed by the fitness of the arrangement which ordains that these young fishes are placed from the first amidst a rich surface-fauna of minute forms which serve them as food. These range from the microscopic Infusoria, which cause the crest of every ripple at the ship's side to sparkle with light and the tow-nets to gleam like tunnels of fire; the wonderful Plutei, or painter's easel-like larvæ of star-fishes, swarms of larval sea-acorns, Copepods, and the beautiful zoeæ of the higher crustaceans. Besides these, are the peculiar Appendiculariæ and Sagittæ, and countless myriads of larval mussels, which in summer crowd the surface of St. Andrew's Bay, and at a still later stage, as they are forsaking their pelagic existence to settle on the stones and seaweeds, form the food of the more advanced young cod, haddock, whiting, coal-fish, pollack, and others that seek shelter for a time amidst the shaggy belt of tangles encircling the rocks. The latter thus in their larval state, by nourishing in their profusion the delicate young of the food fishes, in a sense repay the wise conservancy bestowed by the Town Council of this city on the fine mussel-beds of the Eden. It will, moreover, be observed that it is not only the eggs of the higher marine animals which float, but that for a long time zoologists have been familiar with the pelagic eggs and young of many invertebrate groups of importance. How else, indeed, could the ubiquitous mussels, the sedentary oysters, and the equally stationary sea-acorns and barnacles be spread throughout the ocean? Moreover, not only do these swimming larval forms nourish the very young food-fishes around them, either directly or indirectly, but as they—for instance, the young crabs, lobsters, star-fishes, and mussels—grow larger and older, a kind of rain, so to speak, of such forms takes place from the surface to the bottom, which is readily taken advantage of by the larger fishes, and thus the wonderful cycle is completed.

Finally, I need not point out to you the importance of the Marine Laboratory, to which I have already alluded, and at which the foregoing and other investigations were made during the summer. We have facilities in this and in the Practical Class, which are unusually favourable for study and research, but at the same time our responsibilities are not diminished by such advantages. We must all render an account of our stewardship. When I mention that many facts have yet to be determined in regard to our common food-fishes—their development, rate of growth, their life-histories and migrations—that we have much to find out as to the best methods of increasing such valuable fishes as the cod, the haddock, the sole, and turbot, and of maintaining that increase, it will be apparent that such problems are not only of moment to us but to the country, and that we cannot begin too soon to attempt their solution, as well as to increase our knowledge in regard to many of the lower forms of animal life.

THE NEW UNIVERSITY OF STRASBURG

THE following account of the new university buildings of Strasburg is taken, with a few abbreviations, from an article contributed to our contemporary *La Nature*, by M. Charles Grad, who is himself a deputy to the Imperial Reichsrath from Alsace.

On Monday, October 27th, 1884, the new buildings of the University of Strasburg were opened with due formalities. These buildings form an entire quarter of the city, and constitute a magnificent series of palaces for the prosecution of science. No city in Europe, not even excepting the great capitals, can show such a rich provision for higher education, or one in which the various parts are so admirably combined. Every branch of study has its own proper and distinct location allotted to it, with laboratories, museums, library, and special appliances. It has been done on the large scale, and most successfully. The Imperial Government and the representatives of the Alsatian population arrived at an understanding, and vied in their efforts to endow the province of Alsace-Lorraine with a school of learning unrivalled in its arrangements and in its wealth of buildings. Even those who were most severely touched by the annexation to Germany, agree that in raising this splendid monument—the new University of Strasburg—the one wish has been to serve the interests of science apart from all sinister or narrow national considerations.

The former Académie of Strasburg, broken up in 1870 by the war, was replaced by the new University by virtue of a decree issued from the Chancelry of the German Empire, under date of December 11th, 1871—the same day on weich the additional convention of the treaty of peace was signed at Frankfort. This decree entrusted the organisation of the teaching staff to M. von Roggenbach, formerly Minister of the Grand Duchy of Baden. From the summer semester of 1872 onwards a body of forty-two professors constituted the staff. They began their work on May 1st of that year, being the three hundred and fifth anniversary of the opening of the Académie, which was founded May 1st, 1567, by the Stattmeister Johann Sturm von Sturmeck. At the present time the new University of Strasburg counts seventy-three ordinary and nineteen extraordinary professors, who during the summer semester of the year 1884, have conducted in the five faculties no fewer than 242 courses of lectures and classes. The work is thus distributed between the five faculties:

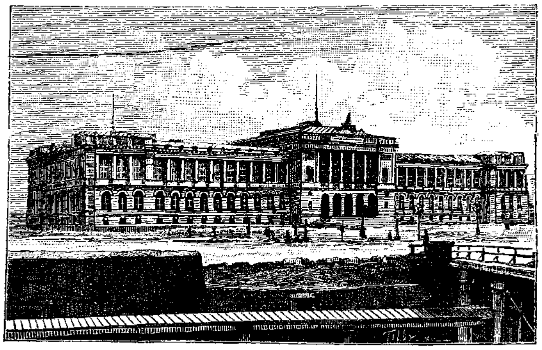

FIG. 1.—University of Strasburg: The Collegiate Palace.

Faculty.	Professors.	Classes and Lectures.
Theology	7	26
Law and Political Sciences	12	29
Medicine	26	60
Philosophy	25	77
Natural Sciences & Mathematics	22	50

Side by side with the laboratories and hospitals attached to each special branch of the natural and medical sciences, there exist the seminaries appropriate to the other branches of learning duly equipped for the purpose of initiating the student into the real work of his subject. A fine library of 560,000 volumes, and a reading-room furnished with 571 periodicals, reviews, and journals, are fitted up in the ancient episcopal residence or château, for the use of both pupils and masters. At the beginning of